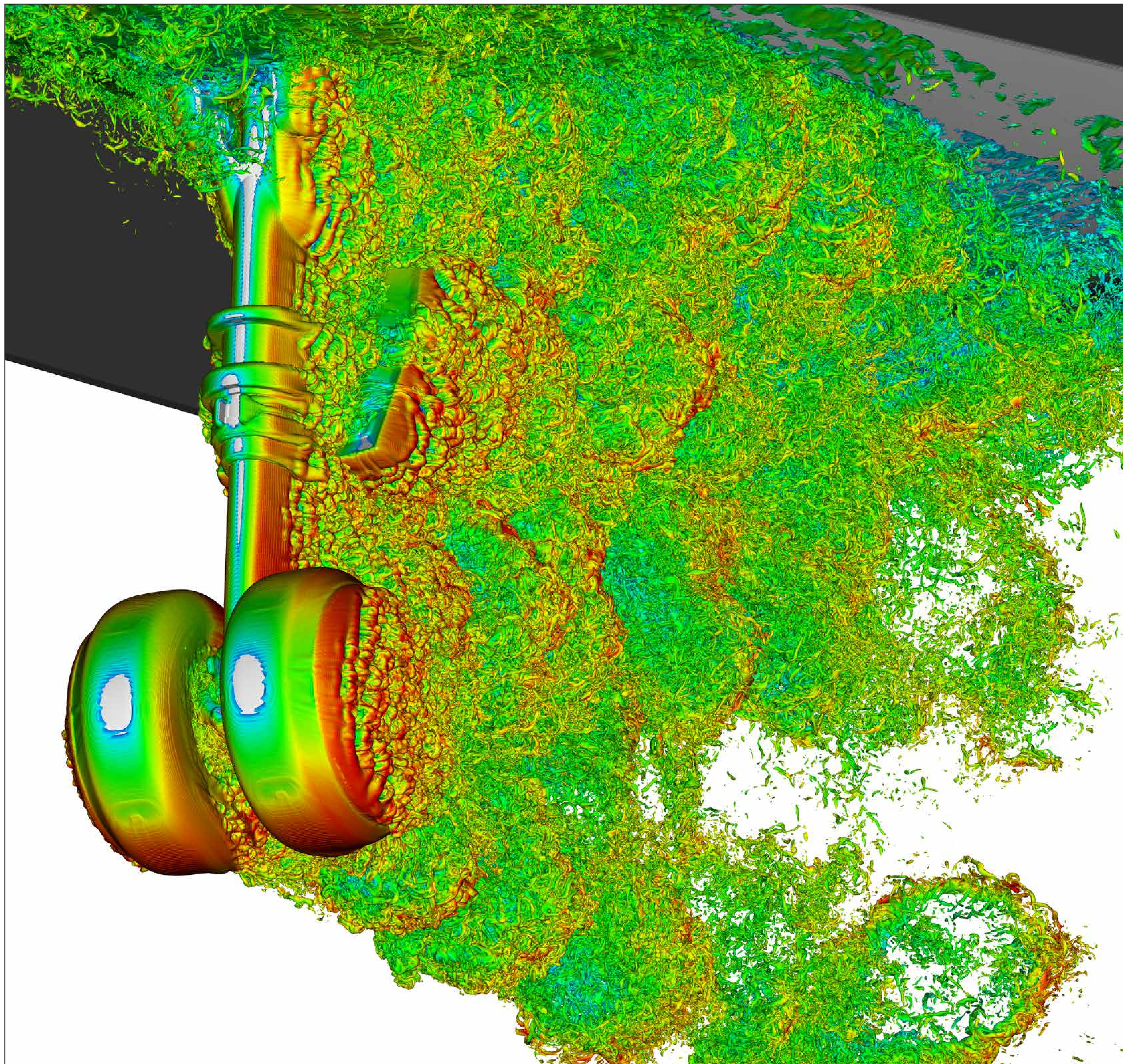
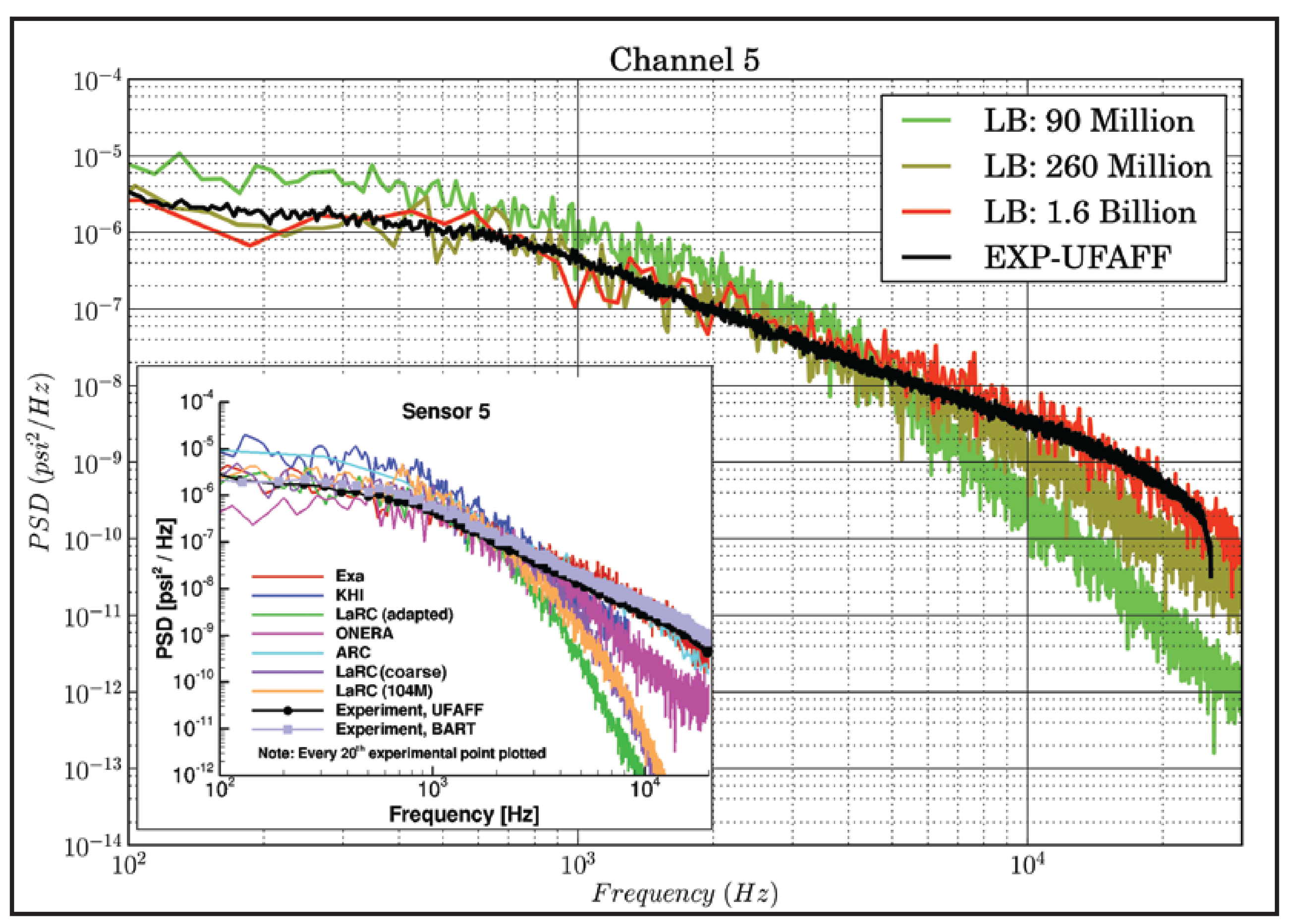
National Aeronautics and
Space Administration





Simulation of landing gear noise using the Launch, Ascent and Vehicle Aerodynamics (LAVA) Cartesian Lattice-Boltzmann discretization. Isocontours of vorticity are shown, colored by Mach number (blue is M=0.0 and red is M=0.25). Twelve levels of mesh refinement are used, resulting in a simulation with 2.28 billion computational cells.
Michael Barad, Joseph Kocheemoolayil, NASA/Ames

Power spectral density of sound on the landing gear strut. The main chart shows a grid refinement study using LAVA Lattice-Boltzmann methods, where the color indicates mesh resolution (red is finest, green coarsest), and the black line represents experimental data. The inset chart shows data taken from a presentation by the AIAA BANCIII (2015) workshop organizer, showing results using other CFD codes on the same case. *Michael Barad, Joseph Kocheemoolayil, NASA/Ames*

Lattice Boltzmann for Airframe Noise Predictions

Our primary goal is to increase the predictive use of high-fidelity computational aero-acoustics (CAA) capabilities for NASA's next-generation aviation concepts. Although computational fluid dynamic methods have been used substantially in analysis and design for steady-state problems, computational resources are extremely challenged for high-fidelity unsteady problems—such as unsteady loads, buffet boundary, jet and installation noise, fan noise, active flow control, and airframe noise. To achieve our goal, we need new techniques for: reducing the resources used by current high-fidelity CAA; routine acoustic analysis of aircraft components at full-scale Reynolds numbers from first principles; and an order-of-magnitude reduction in wall-time-to-solution. Lattice-Boltzmann methods can deliver all of these requirements.

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